Exhibit 5

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Attorneys for Plaintiff
TS-Optics Corporation

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

TS-OPTICS CORPORATION, Plaintiff, v. MICROSOFT CORPORATION, Defendant.	Case No. 8:24-cv-01974-DOC-DFM **DECLARATION OF STEVE SHEN, PH.D. IN RESPONSE TO DECLARATION OF DR. RONALD BARRETT**

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I, Steve Shen, Ph.D, declare as follows:

1. I have been asked by counsel for plaintiff TS-Optics Corporation ("TS-Optics") to provide my opinions in responding to Declaration of Dr. Ronald Barrett In Support of Defendant's Opening Claim Construction Brief that I understand was served on July 25, 2025 (the "Barrett Decl."). In particular, I was asked to address Dr. Barrett's opinion regarding the "unipolar magnets" term from U.S. Patent No. 7,266,055 (the "'055 patent").

2. I have not been asked to address any of the other terms addressed in the Barrett Decl. I understand that I may be asked to address other patents (or terms) in the future, and I reserve the right to provide such an opinion in the future.

3. I am being compensated at a consulting rate of $685 an hour. I am also being reimbursed for any out-of-pocket expenses. My compensation does not depend in any way on the particular testimony or opinions that I express in this disclosure, or on the outcome of this litigation.

4. For this declaration, I have been asked to specifically address Dr. Barrett's opinion regarding the meaning of "unipolar magnets" in the '055 patent as well as to respond to Microsoft's related arguments, to the extent they are known by counsel for TS-Optics. I reserve the right to, if asked, further expound on or explain my opinions in this declaration in connection with claim construction briefing.

5. I reserve the right to respond to any later disclosed opinions, declarations, or arguments made by Microsoft or its experts during claim construction.

6. I have prepared this disclosure having reviewed the '055 patent, the file history of the '055 patent, a Google machine translation of Korean Application 10-2003-0035305 (which the cover of the '055 patent discloses as containing "foreign application priority data"), the relevant aspects of the Barrett Decl. and cited exhibits, Microsoft's Petition for *Inter Partes* Review of U.S. Patent No. 7,266,055 in IPR2025-00767, and the parties' claim construction disclosures. I have also

reviewed the material specifically cited within this Disclosure.

I. QUALIFICATIONS

7. My qualifications generally are set forth in my Curriculum Vitae, which is attached as **Appendix A**. Appendix A also includes a list of the publications I have authored and a list of the other cases in which I have testified during the last four years. I have extensive experience in this area as evidenced in my CV. I highlight some of this experience below.

8. I have been involved in the areas of data storage systems, precision machines, sensors, actuators, and medical/dental devices for more than 40 years in the capacity as a scholar, professor, reviewer, author, editor, speaker, conference chair, professional community leader, consultant, inventor, mentor, advisory board member, and entrepreneur. Since I have broad expertise, I will only explain below my experience and qualification relevant to the Lorenz force and optical disk drive technology, which is the core of the disputed issue I address below.

9. I received my PhD in Mechanical Engineering in 1991 from the University of California, Berkeley. I was an Assistant Professor in the Department of Engineering Mechanics at the University of Nebraska-Lincoln from 1991 to 1993. I joined the University of Washington in 1993 as an Assistant Professor. I am currently a Professor in Mechanical Engineering at the University of Washington.

10. I started my career in data storage when I was a PhD student at the University of California, Berkeley, conducting research on vibration of hard disk drives. With the growth of data storage industry in 1990, I built my expertise in spindle motors, voice coil motors, and electromagnetic actuators, all of which use coils and magnetic fields to generate a Lorenz force to enable motion. Specifically, I was the first person who identified the source and found the solution of an unknown vibration phenomenon of disk drive spindle motors that limited the growth of the track density in hard disk drives. From 1995 to 2015, I conducted theoretical and experimental studies to help disk drive industry to shift the paradigm of spindle

motors from ball bearings to fluid-dynamic bearings. I have also studied auto-balancing of spindle motors, which is unique to optical disk drives.

11. In the US, a premier professional society for data storage professionals is the Division of Information Storage and Processing Systems (ISPS) of American Society of Mechanical Engineers (ASME). One branch of ISPS is devoted to optical storage. ISPS holds an annual conference, where major research results in the field of data storage are presented and published. ISPS also holds joint international conferences with its counterpart in Japan and Korea, where research and development of optical drives is active. ISPS has its own journal, which was initially devoted entirely to data storage and processing systems but later expanded to its present form of *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*.

12. I have played a pivotal role of ISPS's success in 1995-2015. I helped ISPS grow its annual conference by organizing symposia on motor and actuator research and development. In 2006, I served as the chair of a US-Japan Joint Conference on Micromechatronic Intelligent and Precision Equipment. In 2007, I chaired the ISPS Division. From 2002 to 2012, I was a member of the editor board of the *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*. I also served as a guest editor in 2006 for the proceedings of the US-Japan Joint Conference. One of my responsibilities was to review papers related to optical drives, and many of them involved optical pickup actuators and their designs.

13. My CV in Appendix A lists my other qualifications and background, some of which are also relevant for. The description above is simply meant to highlight some of my qualifications.

II. MY UNDERSTANDING OF THE RELEVANT CLAIM CONSTRUCTION LEGAL PRINCIPLES

14. It is my understanding that to ascertain the meaning of claims, the Court

looks to three primary sources: the claims, the specification, and the prosecution history.

15. It is my understanding that the specification must contain a written description of the invention that enables one of ordinary skill in the art to make and use the invention. It is my further understanding that the patent's claims must be read in view of the specification, and that for claim construction purposes, the description may act as a sort of dictionary, which explains the invention and may define terms used in the claims. In addition, it is my understanding that the patentee is free to be his own lexicographer, but any special definition given to a word must be clearly set forth in the specification.

16. It is my understanding that it is the role of the claims, not the specification, to set forth the limits of the patentee's invention. Otherwise, there would be no need for claims. It is my further understanding that one purpose for examining the specification is to determine if the patentee has limited the scope of the claims. In addition, it is my understanding that although the specification may indicate that certain embodiments are preferred, particular embodiments appearing in the specification will not be read into the claims when the claim language is broader than the embodiments.

17. It is my understanding that the words used in a claim are generally given their plain and ordinary meaning. It is my further understanding that the plain and ordinary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention, that is, as of the effective filing date of the patent application. In addition, it is my understanding that the person of ordinary skill in the art is deemed to have read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification, because the claims are part of a fully integrated written instrument.

18. It is my understanding that the prosecution history is intrinsic evidence

that is relevant to the determination of how the inventor understood the invention and whether the inventor limited the invention during prosecution by narrowing the scope of the claims. In addition, it is my understanding that to operate as a disclaimer, the statement in the prosecution history must be clear and unambiguous, and constitute a clear disavowal of scope.

19. It is my understanding that extrinsic evidence, such as dictionary definitions or expert testimony, may be considered during claim construction, but that extrinsic evidence is subordinate to the intrinsic record.

20. With respect to indefiniteness, I understand that a claim element is indefinite if, read in light of the specification, and the prosecution history, the claim element fails to inform, with reasonable certainty, those skilled in the art about the scope of the claim element.

21. It is my understanding that it is the burden of the party asserting indefiniteness to demonstrate that a claim element is indefinite.

III. THE LEVEL OF ORDINARY SKILL IN THE ART

22. Paragraph 16 of the Barrett Decl. discloses the following:

> Having reviewed the ’055 Patent and its Prosecution History, in my opinion, a POSITA would have at least a bachelor’s degree in in [sic] mechanical or electrical engineering and two to five years of industry experience in designing optical storage devices, disk drives or in a similar field. A POSITA could substitute additional education for experience, *e.g.*, substituting an advanced degree relating to the mechanical design of storage 15 systems, including optical storage devices and drives, for industry experience in a related field and vice versa.

23. While I do not disagree that a bachelor’s degree in mechanical or electrical engineering is appropraite, and that additional education can replace experience, it is my opinion that “industry experience in designing optical storage devices, disk drives or in a similar field” is incorrect. I similarly disagree that a “degree relating to the mechanical design of storage 15 systems” is sufficient because, in addition to the issue addressed below, I am not familiar with what

"storage 15 systems" are.

24. The '055 patent is directed to an optical disk drive, and particularly the optical pickup actuator (sometimes called an optical pickup unit) used in optical disk drive. *E.g.*, '055 patent at claim 1 (preamble), 1:16-19; *see also* Barrett Decl. at ¶¶ 18, 21-23. As shown in Fig. 3, an optical pickup uses optical methods to "record information on, or reproduce[] information from" an optical disk using an objective lens. '055 patent at Fig. 3, 5:66-6:11. An optical pickup actuator is used to move the objective lens in various directions to aid in reading and writing data. *Id.* at 6:12-18. Features of the optical pickup actuator are claimed by the '055 patent. *E.g.*, *id.* at claim 1.

25. Optical disks, optical pickups, and optical pickup actuators are not used in other types of disk drives or storage systems. For example, tape drives (that store data in a magentic tape), hard disk drives (that store data in magnetic platters), and solid state drives (that store data in solid state memory chips) do not use such hardware. Because Dr. Barrett opines that a person of ordinary skill in the art could have experience solely with designing hard disk drives and no experience with optical disk drives, I disagree with Dr. Barrett's opinion and believe his opinion regarding the level of ordianry skill is too broad.

26. It is my opinion, based on the dislcosures of the '055 patent that I discuss above, that the level of ordinary skill should include at least two years of experience designing optical disk drives (or its equivalent).

IV. CONSTRUCTION OF "UNIPOLAR MAGNETS"

27. I understand the Microsoft and Dr. Barrett argue that the term "unipolar magnets" in claim 40 of the '055 patent is indefinite, and TS-Optics argues that the term is not indefinite and should be given its plain and ordinary meaning, which is "magnets that each have a face with a single pole." As I say above, it is my understanding that a term is indefinite if the meaning of the term is not reasonably certain to a POSITA in light of the intrinsic evidence.

28. I disagree with Microsoft's and Dr. Barrett's argument because the meaning of the term is reasonably certain to a POSITA in light of the intrinsic evidence, including Microsoft's own arguments to the PTAB.

A. Relevant Intrinsic Evidence

29. I have reproduced claim 40 of the '055 patent and highlighted the "unipolar magnets" term:

> 40. An optical pickup actuator for use with an objective lens on a base, comprising:
>
> a blade holding the objective lens;
>
> a plurality of suspension wires movingly supporting the blade on the base;
>
> a plurality of hinges each of coupled to an end of a suspension wire;
>
> a pair of ***unipolar magnets*** positioned on the base; and
>
> a plurality of coils connected to an electric circuit and interacting with ***the unipolar magnets*** to create an electromagnet force to move the blade; and
>
> wherein at least one of the plurality of coils is divided into subcoils and a hinge coupled to each of the plurality of suspension wires is between an adjacent pair of subcoils.

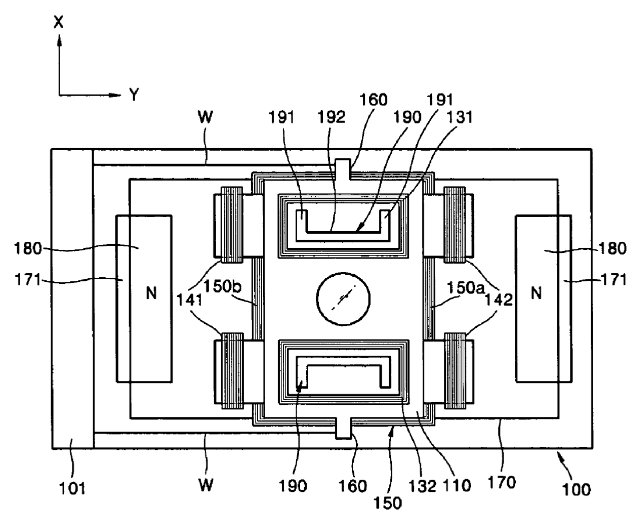
30. The term is used in a similar manner in other claims in the '055 patent. '055 patent at claims 7 ("a pair of unipolar magnets disposed opposite each other"), 8 (same), 15 (same), 21 (same), 28 (same), 36 ("a pair of unipolar magnets positioned on the base"), 39 ("only a single pair of unipolar magnets").

31. In the specification, the inventors disclose that the prior art is designed as having four magnets (21a, 21b, 22a, and 22b), which means that the prior art "optical pickup actuator needs to be designed to avoid interference with a spindle motor (not shown) for rotating the disc." *Id.* at 2:66-3:8. The invention is disclosed as addressing the "increase in demand for super-slim disk drives" that requires, among other things, "reducing the number of parts of an optical pickup actuator." *Id.* at 3:5-13.

32. The inventors disclose that part of their solution to the identified

problem is to use a single pair of magnets (instead of two pairs). *Id.* at 6:25-29, 6:34-37 (the problems of too many magnets and spindle motor interference are addressed by using a single pair of magnets). In a preferred embodiment, the inventors further disclose that the pair of magnets are "disposed opposite to each other" and "are unipolar and magnetized with an N pole" or "S pole." *Id.* at 6:29-34. Fig. 5 demonstrates this preferred embodiment and is reproduced below, with the magnets labeled 180.

FIG. 5



In another embodiment, the unipolar magnets are described as being "disposed opposite each other" and "magnetized to have the same polarity." '055 patent at 4:57-61.

33. In the file history, the examiner found that claim 40 was understandable and valid, and did not raise any issue understanding the meaning of "unipolar magnets" in the context of the intrinsic evidence. *See* Jan. 5, 2007 Office Action (allowing then draft claim 42 that became claim 40 in the '055 patent).

34. I also used Google Translate to machine translate paragraph 26 of the Korean priority document, Korean Application No. 10-2003-0035305. This paragraph reads: "As a magnetic member that induces electromagnetic force in the coils by interaction with the coils, at least one pair of magnets positioned facing each

other in the second direction with the blade as the center and ***monopolarized with the same polarity*** may be provided." This same language ("monopolarized with the same polarity") is used in paragraph 19 of the machine translated Korean priority document.

35. Finally, Microsoft filed a petition for *inter partes* review challenging many of the claims using the "unipolar magnets" terms (claims 7, 8, 15, 21, 28, 36, and 40).[1] IPR2025-00767 at paper 1 (the "IPR Pet."). Microsoft informed the PTAB that it did "not believe construction of any term," including the "unipolar magnets" term, "is necessary to resolve the invalidity challenges." IPR Pet. at 6. Microsoft further explained that "[i]n the optical pickup actuator context, a unipolar magnet refers to using the magnet such that only one pole-either north or south (but not both)-faces and interacts with a particular coil," citing the '055 patent at Figs. 5, and 6:19-54. IPR Pet. at 21-22. Microsoft distinguished a "unipolar magnet" from a "bipolar interaction" (citing magnets 21a and 21b in Fig. 2 of the '055 patent that show a face of the magnet having both a north and south pole as an example of a "bipolar interaction"). *Id.* at 22-23.

36. Microsoft's IPR expert, Dr. Mansuripur, provided an opinion very similar to Microsoft's arguments. IPR2025-00767, Ex. 1002 at ¶¶ 67-70 ("Mansuripur IPR Decl."). Dr. Mansuripur concluded, based on the intrinsic evidence, that "a POSITA would have understood the recitation of a pair of unipolar magnets in claim 7 refers to unipolar interaction of the magnets with the coil(s) facing those magnets." *Id.* at ¶ 70. Dr. Mansuripur further notes that Fig. 5 of the '055 patent does not illustrate the south pole "because its illustration was not relevant to the magnetic interaction" and he went on to further note that a POSITA would understand that Fig. 2, "which also shows a unipolar interaction, more clearly labels both the north and south poles of magnets (22a, b)." *Id.* at ¶ 68.

[1] Microsoft did not challenge claim 39 in its IPR petition. This is irrelevant to my opinion here.

37. Based on its arguments and the Mansuripur Decl., Microsoft argued that "unipolar magnets" was inherent and/or obvious in each of four cited references. *E.g.*, IPR Pet. at 23, 52-53, 62-63, 77. By invoking the doctrine of inherency for at least one of the references (*e.g.*, IPR Pet. at 23), Microsoft not only told the PTAB that "unipolar magnets" was reasonably understandable, but that a POSITA would have been necessarily understood[2] that such magnets were disclosed in their reference.

B. Response To Dr. Barrett's Opinion

38. In light of intrinsic evidence I outline above, it is my opinion that POSITA would understand that "unipolar magnets" are "magnets that each have a face with a single pole." As Microsoft and Dr. Mansuripur explained to the PTAB, "[i]n the optical pickup actuator context, a unipolar magnet refers to using the magnet such that only one pole-either north or south (but not both)-faces and interacts with a particular coil," citing the '055 patent at Figs. 5, and 6:19-54. IPR Pet. at 21-22 (citing Mansuripur IPR Decl. and '055 patent at Figs. 5, 6:19-54). Microsoft told the PTAB that the term was not only reasonably understandable, but that a POSITA would have necessarily understood the disclosure of this limitation in the prior art. *E.g.*, IPR Pet. at 23. Microsoft (here) and Dr. Barrett do not acknowledge Microsoft's previous argument to the PTAB, let alone explain the discrepancy.

39. The intrinsic evidence is consistent with TS-Optics' proposal and Microsoft's IPR description of the understanding of a POSITA. In both the claims and specification, the unipolar magnets are consistently described in pairs, and are often described as being "opposite each other" and magnetized with the same pole. '055 patent at 4:57-61, 6:29-34. Just as Microsoft and Dr. Mansuripur argued

[2] It has been explained to me that a claim limitation can be "inherent" in prior art if the limitations necessarily flows from the disclosure of the prior art. It may not simply be a possibility, but must be necessary based on the disclosure of prior art.

to the PTAB, this supports the understanding that the "unipolar magnets" term refers to magnets with a single pole on their face, not like the bipolar magnets shown in Fig. 2.

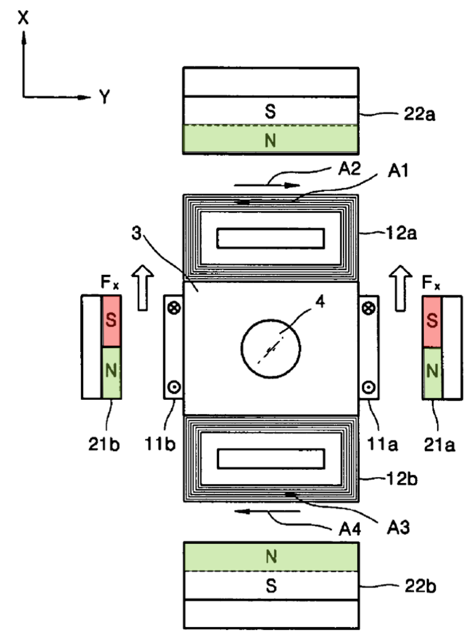


Figure 2 of '055 patent (annotated)

40. Above is an annotated version of Figure 2 of the '055 patent prepared by Microsoft. IPR Pet. at 23. According to Microsoft, it demonstrates how a POSITA would understand the "unipolar magnets" terms in light of the intrinsic evidence (they are labeled 22a and 22b) as opposed to bipolar magnets (labeled 21a and 21b). I agree that this is consistent with how a POSITA would understand the meaning of "unipolar magnets" given the intrinsic evidence I discuss above.

41. Dr. Barrett does not address the understanding of a POSITA after reading the intrinsic evidence. Rather, it appears that Dr. Barrett is considering the term "unipolar magnets" without the context of the intrinsic evidence. This is apparent because Microsoft has already admitted that the meaning of this term is known "[i]n the optical pickup actuator context." In my opinion, Dr. Barrett is wrong to ignore the "optical pickup actuator context," which is apparent from all of the intrinsic evidence, including, for example, claim 40 and 1:15-19 of the '055 patent (defining the field of the invention).

42. Microsoft's and Dr. Mansuripur's arguments in the IPR directly contradict Dr. Barrett's opinions here. Microsoft and Dr. Mansuripur not only argue that "in the context of optical pickup actuators" that "unipolar magnets" have a readily apparent meaning (which I agree with), but they argue that the use of such magnets would have been inherent and obvious to a POSITA (depending on the reference).[3] Dr. Barrett does not address the conflict between Microsoft's and Dr. Mansuripur's arguments in the IPR. Dr. Barrett also does no explain why he approvingly cites portions of Microsoft's and Dr. Mansuripur's IPR arguments (Barrett Decl. at ¶¶ 58, 64) while ignoring the portion of Microsoft's and Dr. Mansuripur's arguments that contradict with his opinion.

43. Further evidence supporting my opinion that Dr. Barrett's opinion does not consider the intrinsic evidence is that a POSITA would understand that the invention could not work if Dr. Barrett's "magnetic monopoles" interpretation of "unipolar magnets" was adopted.

44. The basic operation of the invention of the '055 patent utilizes the Lorenz force in classical physics. As the '055 patent discloses, the field of the invention is a "optical pickup actuator employing a Lorenz force generated in a coil by electromagnetic induction." '055 patent at 1:16-19. A POSITA would know that the Lorenz force is a well-known physics force created as a result of an interaction between a magnetic field (created by a magnet) and a charged particle (created by current following in a coil). It is the Lorenz force that allows the optical pickup actuator to adjust the objective lens. Use of the Lorenz force is further acknowledged by the specification where it describes the preferred embodiment of the "unipolar

[3] I have not been asked to, and I do not, provide any opinions about Microsoft's IPR invalidity arguments in this declaration. I reserve the right do so in the future if requested by TS-Optics. My opinion regarding Microsoft's arguments about the disclosures of the references cited in its IPR petition does not alter the representation made by Microsoft and Dr. Mansuripur to the PTAB regarding their understanding of the "unipolar magnets" term.

magnets" (magnets 180) being used to create "electromagnetic forces" in various directions. *E.g.*, '055 patent at 6:39-48, 7:12-8:67.

45. Indeed, Dr. Barrett acknowledges that this Lorenz force interaction is important for the claimed invention because he opines that claim 40 requires "(2) the pair of unipolar magnets interact with a plurality of coils connected to an electric circuit; and (3) that interacting create an electromagnet [sic] force to move the blade." Barrett Decl. at ¶ 57. Again, however, Dr. Barrett does not explain why he ignores this basic aspect of the invention as described in the intrinsic evidence.

46. The invention applies to a real-world application (an optical pickup actuator) governed by principles of classical physics (as opposed to quantum physics). In order to create the Lorenz force in classical physics (or the required electromagnetic force Dr. Barrett refers to in his own description of the invention), a magnetic field must be created as a result of magnetic flux, which flows from a north to a south pole. If, as Dr. Barrett opines, the invention called for using only a standalone magnetic monopole of one polarity, there would be no opposite pole in the claimed invention and no magnetic field would be created. As a result, there would be no Lorenz force and the optical pickup actuator would be unable to perform its intended purpose of moving the objective lens.

47. In the articles cited by Dr. Barrett, it is explained that the theoretical realization of a magnetic monopole of a single polarity can only be possible at a quantum state, which is only observable at extremely tiny scales, such as atoms. That means, even if it existed, it would not be observable in the classical physics world whose principles the POSITA would use to develop the optical pickup actuator invention addressed in claim 40 of the '055 patent. Although Dr. Barrett acknowledges the requirements of the claims (addressed above, citing Barrett Decl. at ¶ 57) and that the invention address "real-world applications" (Barrett Decl. at ¶ 59), he does not explain why he believes a POSITA would have understood "unipolar magnets" to refer to a quantum-level magnetic monopole as opposed to

reasonable explanation proposed by TS-Optics, Microsoft (in its IPR petition), and Dr. Mansuripur.

48. I also note that Dr. Barrett refers to "pseudo-monopole magnetic" and "pseudo-monopole magnets" but does not cite what he bases this opinion on (or the source for his cited "pseudo-monopole magnetic" theory). Barrett Decl. at ¶¶ 60-61. But, as Dr. Barrett correctly concludes, there is no evidence that "the applicants intended to claim a pseudo-monopole magnetic" made up of 8 magnets in his proposed shape. *Id*. at ¶ 61. It is not clear why Dr. Barrett offers this opinion.

49. Given the disclosure of the intrinsic evidence, and the POSITA's knowledge of the Lorenz force, a POSITA would not conclude that "unipolar magnet" in claim 40 referred to a magnetic monopole as opposed to magnets that each have a face with a single pole. This is the same conclusion Microsoft and Dr. Mansuripur arrived at in the IPR.

50. I therefore disagree with Dr. Barrett's opinion. The correct construction of "unipolar magnets" is "magnets that each have a face with a single pole," which is consistent with the intrinsic evidence, including Microsoft's own arguments to the PTAB.

I declare under penalty of perjury pursuant to the laws of the United States that the foregoing is true and correct.

Executed on August 8, 2025 at Seattle, Washington.

Dr. Steve Shen

Exhibit A

I. Y. (Steve) Shen

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EDUCATION

Ph.D. **University of California, Berkeley, CA.,** Mechanical Engineering, May 1991.
Major: Dynamics and Vibration
Minor: Solid Mechanics, Applied Mathematics
Mentor: C. D. Mote, Jr.

M.S. **National Taiwan University, Taipei, Taiwan,** Mechanical Engineering, June, 1986.

B.S. **National Taiwan University, Taipei, Taiwan,** Mechanical Engineering, June, 1981.

PROFESSIONAL EXPERIENCE

9/02 – present: **Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

1. Major research areas include disk drive dynamics (e.g., spindle motors, disk media, glide heads, and suspension systems), vibration of rotating machines (e.g., machine tool spindles, dental/surgical drills, turbines, compressors, motors, bearings, rotor blades, chucks/collets, motor/rotor noise control, rotor-housing interaction, and balancing), PZT thin-film micro-sensors/actuators and piezoelectric MEMS (e.g., structural health monitoring sensors for aircraft panels, anti-slip yaw-rate sensors for automobiles, and microphones), medical/dental devices (e.g., hearing implants, hearing aids, intracochlear microactuators and microphones, implant stability testers for dental implants and bone screws, dental/surgical drills, ultrasonic dental scalers, ultrasonic surgical aspirators), fluid-structure interaction (e.g., MEMS devices in aqueous environments), cochlear mechanics, autonomous flying vehicles (e.g., high-payload high-endurance drones, flapping-wing drones, blade aerodynamic design, thin-film rate gyros for guidance and motion control), nanotechnology and nanomanufacturing (e.g., PZT nano-particles), flexible electronics and additive manufacturing (e.g., PZT inkjet printing, PZT-silane nano-composite thin films, 3D printing of piezoelectric materials), sports dynamics (e.g., alpine-tour ski boots and bindings), damping technology (e.g., passive/active/hybrid damping, isolation), linear and nonlinear vibration.

2. Responsible for teaching undergraduate and graduate courses in systems and dynamics (ME 230, ME 373, ME 374, ME 469), vibrations (ME 470, ME 588, ME 589, ME 590), mechanical design (ME 495), and applied mathematics (ME 564, ME 565). Typical undergraduate class size is from 160 to 270 students for required

courses ME 230, ME 373, and ME 374. Typical graduate class size for ME 588 is 30 to 50 students.

9/08 – 3/12: **Graduate Program Coordinator**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

9/96 – 9/02 **Associate Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

12/93 - 9/96 **Assistant Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

7/94 - 9/94 **Summer Fellowship Recipient**, Phillips Laboratory, AFOSR, Albuquerque, NM.

8/91 - 12/93 **Assistant Professor**, Department of Engineering Mechanics, University of Nebraska, Lincoln, NE.

LEADERSHIP EXPERIENCE

8/21 – present: **Founder**, Quiver Dental, Inc.

1. Founded and registered Quiver Dental, Inc. in the State of Delaware.
2. Commercializing a diagnostic tool to measure stability of dental implants based on intellectual properties I developed at the University of Washington.
3. Secure non-dilutive funds, including an NSF STTR phase 1 grant, two Washington Research Foundation phase 1 commercialization grants, a WE-REACH grant, and a Co-Motion Commercialization Fellowship, totaling around $650,000.

3/14 – 12/19: **Technical Editor**, ASME Journal of Vibration and Acoustics

4. Maintained day-to-day journal operations (550-650 annual submissions), appointed and recruited effective associate editors, managed 25 associate editors and 1 assistant, controlled budget and expenditures, conducted quarterly reviews of associate editors, communicated with ASME headquarter regularly to ensure smooth operations, resolved author/reviewer conflicts, investigated and processed alleged academic misconducts, published quarterly/semi-annually newsletter "*The Latest Vibe*," and reported to constituents in three different ASME conferences and meetings.
5. Major achievements:
   A. Doubled journal impact factor from 1.147 (in 2013) to 2.343 (in 2019).
   B. Reduced time in review from 186 days (in 2013) to 99 days (in 2018).
   C. Reversed budget deficit to huge surplus by employing an hourly-paid assistant.
   D. Initiated and instituted a Best Paper Award for the Journal of Vibration and Acoustics.
   E. Nominated and won Melville Medal for the Journal of Vibration and Acoustics.
   F. Rebuilt the reviewer database.
   G. Published 5 special issues.
   H. Nominated and promoted 6 Associate Editors to ASME fellow grade.
   I. Launched team-building activities, such as annual dinner for associate editors.

9/08 – 3/12: **Graduate Program Coordinator**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

1. Responsible for graduate student affairs including recruitment, evaluation, retention, daily operation, staff management, resolution of conflicts, seminar and qualifying

exam coordination, proposal writing (e.g., scholarships and internal grants), student exchanges, marketing, web site development, and interaction with Graduate School.

2. Major achievements:
   A. Departmental graduate program ranking ascended from 31 (2009 publication) to 24 (2013 publication) nationally according to *US News Best Graduate School Rankings*.
   B. Grew ME PhD program from 70 students to 100 students, and expanded ME graduate program enrollment from 200 to 250 students.
   C. Instituted direct PhD program and multi-year financial assistance offers to recruit exceptional PhD students.
   D. Wrote internal proposals to secure funds for recruiting and retaining graduate students. Successful outcomes include: 3 rounds of diversity fellowship (2 award recipients and one alternate award recipient), 1 Ford Motor Fellowship, 1 Stamps Fellowship, 45 quarters of international tuition waivers, 8 quarters of research assistantship.
   E. Revamped graduate program web sites, such as admission, qualifying exam policy, seminars, and Master of Science Engineering.

7/08 – 9/16 **Past Chair/Chair/Vice Chair/Secretary**, ASME Technical Committee of Vibration and Sound, Design Engineering Division.

06/2006: **Conference Chair**, ASME/ISPS-JSME/IIP Joint Conference on Micromechantronic Intelligent and Precision Equipment, San Jose, CA., USA, 6/21-23, 2006.

06/06 – 05/07: **Guest Editor**, MIPE 2006 Special Issue, *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*.

07/06 – 06/08: **Chair/Vice Chair**, ASME Information Storage and Processing System (ISPS) Division.

SPONSORED RESEARCH

1. Washington Research Foundation (Commercialization Grant Phase 1), *QUIVER on Maxilla: A Gen-2 Diagnostic Device to Measure Dental Implant Stability,* $100,000, 12/01/2023-11/30/2024, PI: I. Y. Shen.

2. National Science Foundation, *STTR Phase I: A Diagnostic Device to Measure Dental Implant Stability,* $254,360, 8/1/2022-7/31/2024, Awarded to Quiver Dental, Inc., Academic PI: I. Y. Shen, UW's share: $125,000.

3. Spencer Fund, UW Department of Restorative Dentistry, *Comparison of initial stability between implants of different thread design and lengths using OSSTELL Resonance Frequency Analysis (RFA) and an experimental modal analysis,* $16,850, 7/1/2022-6/30/2024, PI: Mats Kronstrom, co-PI: I. Y. Shen.

4. University of Washington, WE-REACH, *QUIVER—A Diagnostic Device to Measure Dental Implant Stability,* $175,450, 7/1/2022-6/30/2024, PI: I. Y. Shen.

5. Washington Research Foundation (Commercialization Grant Phase 1), *QUIVER: A Diagnostic Device to Measure Dental Implant Stability,* $50,000, 2/1/2022-1/31/2023, PI: I. Y. Shen.

6. UW CoMotion (Commercialization Fellowship), *A Diagnostic Device to Measure Dental Implant Stability,* $63,965, 11/16/2021-11/15/2022, PI: I. Y. Shen, Fellowship recipient Weiwei Xu.

7. NextFlex (by SEMI/FlexTech Community), *Flexible Printed, Non-toxic Piezoelectric Sensors for Structural Health Monitoring,* $337,517, 10/1/2019-4/30/2021, PI: J. Devin Mackenzie, co-PI: I. Y. Shen's share (~$160k).
8. UW CoMotion (Strategic Technology Enhancement Portfolio Fund), *Prototyping an implant stability tester for dental implant surgical devices,* $20,322, 6/1/2019-8/31/2019, PI: I. Y. Shen.
9. Industrial Technology Research Institute, *Integrated UAV Simulator,* $249,477, 4/1/2018-3/31/2020, PI: I. Y. Shen, co-PI Alberto Aliseda.
10. Industrial Technology Research Institute, High-Speed Spindles for Machine Tools, $170,000, 6/1/2018-5/31/2019, PI: I. Y. Shen
11. National Science Foundation, *Coupled Dynamics Between Flapping Wings and Vibrating Thorax During Insect Flight,* CMMI–1360590, Dynamical Systems Program
    A. $ 257,707, 8/1/2014-7/31/2017, PI: I. Y. Shen.
12. Boeing Company: *Layer Manufacturing of PZT-Silane Nanocomposites*, $70,000, 1/1/14 – 12/31/14, PI: I. Y. Shen, co-PI: Guozhong Cao.
13. Joint Center for Aerospace Technology Innovation (JCATI): *Development of Lead Zirconate Titanate (PZT)-Silane Nano-Composite Thin Film Sensors*, $57,374, 7/1/13 – 6/30/14, PI: I. Y. Shen, co-PI: Guozhong Cao.
14. Boeing Company: *Layer Manufacturing of PZT-Silane Nanocomposites*, $79,957, 4/1/13 – 12/31/13, PI: I. Y. Shen, co-PI: Guozhong Cao.
15. National Science Foundation, *Development of PZT Thin-Film Microactuators for Intracochlear Applications,* CBET-1159623, General & Age Related Disabilities Engineering (GARDE) Program
    A. $ 312,604, 9/1/2012-8/31/2015, PI: I. Y. Shen, co-PIs: Guozhong Cao and Clifford R. Hume.
    B. $ 6,000, 9/1/2014-8/31/2015, Research for Undergraduate Experience.
16. Boeing Company: *Layer Manufacturing of PZT-Silane Nanocomposites*, $109,096, 3/1/12 – 11/30/12, PI: I. Y. Shen, co-PI: Guozhong Cao.
17. Boeing Company: *Layer Manufacturing of PZT-Silica Nanocomposites*, $61,005, 3/16/11 – 11/30/11, PI: I. Y. Shen, co-PI: Guozhong Cao.
18. National Science Foundation, *Vibration Analysis and Health Diagnosis of Spinning Cyclic Symmetric Rotors with Flexible Bearing and Housing Supports*, CMMI-0969024, Dynamical Systems Program
    A. $159,858, 9/1/2010-8/31/2014, PI: I. Y. Shen
19. National Science Foundation, *Bio-Inspired Inner-Ear Microphones via a Piezoelectric Substrate and Nanorods*, CMMI-1030047, Sensor and Sensor Technology Program
    A. $199,836, 7/1/2010-6/30/2014, PI: I. Y. Shen
    B. $6,000, 3/16/2011-12/15/2012, Research for Undergraduate Experience, student: McKenzie Staley.
20. Boeing Company: *Layer Manufacturing of PZT-Silica Nanocomposites*, $61,000, 5/1/10 – 11/30/10, PI: I. Y. Shen, co-PI: Guozhong Cao.
21. National Science Foundation, *Performance Enhancement of PZT Thin-Film Microactuators via a Multi-Scale, Multi-Domain Design*, CMMI-0826501, Sensor and Sensor Technology Program
    A. $239,925, 7/01/2008-6/30/2012. PI: I. Y. Shen, co-PI: Guozhong Cao
    B. $6,000, 9/16/2008-6/30/2009, Research for Undergraduate Experience, Student: Alexia Fisher
    C. $6,000, 12/16/2009-6/30/2010, Research for Undergraduate Experience, Student: Alicia Tan
    D. $6,000, 09/16/2010-6/30/2011, Research for Undergraduate Experience, Student: Cassius Elston

22. National Science Foundation, *A Workshop for NSF "Cyber-Enabled Discoveries and Innovations" Initiative in Conjunction with 2007 ASME International Mechanical Engineering Congress & Exhibition*, CMMI- 0803484, $43,761, 11/1/2007-2/28/2009.
23. Matsushita Electric Industries: *Vibration Analysis of Fluid-Bearing Spindles*, $164,000, 1/16/03 - 1/15/09.
24. Hitachi: *Vibration of Rotating Disks in Air and in Vacuum*, $35,000, 1/1/2007-12/31/2007.
25. National Science Foundation, *Vibration Control of Rotordynamics Using Motors*, CMS-0408777, PI: Brian Fabien, $218,131, 7/1/2004-6/30, 2007, (Shen's effort is 25%.)
26. Western Digital Corporation: *Spindle Dynamics of High-RPM and High-TPI Drives*, $240,000, 9/16/99 - 12/15/06.
27. University of Washington Royal Research Fund Award: *Feasibility Study of Hybrid Cochlear Implants*, $33,889, 6/16/2005-6/15/2006. PI: I. Y. Shen, Co-PI: C. R. Hume and G. Z. Cao.
28. National Science Foundation, *A Unified Approach to Analyze Vibration of Rotating Flexible Structures*, CMS-0244116.
    A. $186,753, 7/1/2003 to 6/31/2006, Dynamics and Control Program
    B. $6,000, 9/16/2003-6/15/2004, Research for Undergraduate Experience, Student: Jessica Bowen
    C. $6,000, 9/16/2004-6/15/2005, Research for Undergraduate Experience, Student: Melinda Herrin
29. Hitachi: *Vibration of Disk/Spindle Systems with Flexible Base Plates*, $60,000, 12/00-12/03.
30. National Science Foundation: *Taming Vibration of Rotating Disk/Spindle System*s, Grant No. CMS-9820745.
    A. $150,888, 9/15/99 - 8/31/02, Dynamics and Control Program
    B. $10,000, 12/16/99-12/15/00, Research Experiences for Undergraduates (REUs)
    C. UW matching fund: $10,000.
31. IBM Graduate Fellowship:
    A. $22,000, 9/16/01-9/15/02, recipient: Jr-Yi Shen
    B. $40,000, 9/16/98 – 9/15/00, recipient: Jessica Yellin.
32. IDEMA Graduate Fellowship: $5,000, 12/16/00-3/15/01, recipient: Baekho Heo.
33. Electro-Mechanic Technology Advancing Foundation, MITI, Japan (via NSK Ltd., Japan): *Vibration Analysis of Spindle Motors with Hydrodynamic Bearings*, $11,450, 3/15/99-9/15/00.
34. IBM Partnership Award*: Vibration of Spinning Disk/Spindle Systems for High-TPI and High-RPM Drives*, $20,000, 7/1/98-6/30/99.
35. Army Research Office: *Surface Damping Treatments: Innovation, Design, and Analysis*, Agreement No. DAAG55-98-1-0387, $240,000, 6/1/98 to 5/31/01; co-PI: Professor Per G. Reinhall of UW.
36. National Science Foundation*: Characterization of Disk/Head Interfacial Contact through System Dynamics and Microelectricalmechanical Sensors*, Grant No. CMS-9800180.
    A. $300,000, 3/16/98 to 3/15/01, split with co-PI Professor Liwei Lin (University of California, Berkeley, Associate Director, Sensor and Actuator Laboratory)
    B. $5,000, 12/16/98 to 6/15/99, Research Experiences for Undergraduates (REUs)
37. Seagate Technology: *Vibration of Glide Heads with Piezoelectric Sensors*, $20,000, 3/98.
38. National Science Foundation*: A Nontraditional Vibration Analysis of Rotating Disk/Spindle Systems and Its Applications to Computer Hard Disk Drives*, Grant No. CMS-9634557.

A. $149,830, 9/1/96 to 8/31/99, Dynamics and Control Program
B. $5,000, 9/16/98 - 6/15/99, Research Experiences for Undergraduates (REUs)
C. $5,000, 12/16/99 - 6/15/00, Research Experiences for Undergraduates (REUs)

39. Alcoa Foundation: *Vibration of Rotating Disk/Spindle Systems*, $10,000, 7/97-6/98.

40. National Science Foundation*: Intelligent Constrained Layer Treatments -- An Innovative Approach*, Grant No. MSS-9496149, $149,852, 1/94-12/98.

41. Royalty Research Fund, University of Washington*: Applications of Self-Sensing Active Constrained Layer Damping Treatments*, $20,000, 2/1/96 to 12/31/97.

42. Conner Peripherals: *Vibration of Next-Generation Disk Drives*, $39,900, 6/15/95 to 6/30/96.

43. Air Force Office of Scientific Research: *Active Constrained Layer Damping Treatments*, 1994 Summer Faculty Fellowship, 7/94-9/94.

44. Research Support Allocation, University of Washington: $32,902 for a laser vibrometer with Professors Foster, Fabien, Ramulu, and Reinhall.

SOFTWARE LICENSE & REGISTRATION

1. HDAVAP v. 2.0 (Disk/Spindle Vibration Analysis Program), University of Washington, 1998, contributor: I. Y. Shen. Licensees: NSK Ltd. (Japan), SAE Magnetics (Milpitas, CA.).

2. HDD Spindle Motor Vibration Analysis Program, University of Washington, 2005, contributors: Jr-Yi Shen and I. Y. Shen. Licensee: Hitachi Ltd. (Japan) at 2005, Samsung Electronics (Korea) at 2006, Data Storage Institute (Singapore) at 2008, and Panasonic Shikokou, Ltd. (Japan) at 2009.

STUDENT SUPPORT

1. Have secured student support from industry through intern positions.

Name	Duration	Source	Amount
Tsung-Liang Wu	10/06-2/07	Western Digital (San Jose, CA.)	$25,000
Jungkeun Yoon	7/02-9/02	Western Digital (San Jose, CA.)	$15,000
Jr-Yi Shen	7/01-8/01	IBM (San Jose, CA.)	$10,000
Richard Kent	7/01-9/01	Seagate (Bloomington, MN.)	$9,600
Baekho Heo	9/00-12/00	Western Digital (San Jose, CA.)	$15,000
Paul Chang	7/00-9/00	Seagate (Fremont, CA.)	$10,000
T. Jintanawan	7/00-9/00	Western Digital (San Jose, CA.)	$15,000
Jr-Yi Shen	6/00-9/00	IBM (San Jose, CA.)	$15,000
Chaw-Wu Tseng	10/99-6/00	Western Digital (San Jose, CA.)	$41,000
Chaw-Wu Tseng	6/99-9/99	Seagate (Oklahoma City, OK.)	$13,500
Jr-Yi Shen	6/99-9/99	IBM Almaden (San Jose, CA.)	$15,000
Shalom Ruben	6/99-9/99	Seagate (Longmont, CO.)	$9,000

Jin-Hui Ou-Yang	1/99-8/99	Seagate (Fremont, CA.)	$32,000
Jung Seo Park	10/98-12/98	Seagate (Bloomington, MN.)	$12,000
Jr-Yi Shen	6/98-9/98	IBM (San Jose, CA.)	$12,000
Baekho Heo	6/98-9/98	Seagate (Fremont, CA.)	$12,000
Alex Tsay	6/97-3/98	Seagate (Fremont, CA.)	$36,000
Matt Shumway	6/96-9/96	Seagate (Scotts Valley, CA.)	$12,000

INDUSTRIAL SHORT COURSES

A. Disk/Spindle Dynamics for Computer Hard Disk Drives.

1. 2005, 8/9-10, Samsung Electronics, Suwon, South Korea.
2. 2004, 10/25-26: Xyratex, Havant, United Kingdom.
3. 2004, 3/25-26: Maxtor Corporation, Shrewsbury, MA.
4. 2003, 7/28-29: Maxtor Corporation, Longmont, CO.
5. 2002, 11/11-12: Maxtor Corporation, Milpitas, CA.
6. 2002, 9/19-20: Maxtor Corporation, Shrewsbury, MA.
7. 2002, 6/24-25: Maxtor Corporation, Longmont, CO.
8. 2002, 4/25-26: Seagate Technology, Longmont, CO.
9. 2002, 3/21-22: Maxtor Corporation, Shrewsbury, MA.
10. 2001, 11/29-30: Maxtor Corporation, Milpitas, CA.
11. 2001, 9/20-21: Maxtor Corporation, Shrewsbury, MA.
12. 2001, 7/16-17: Maxtor Corporation, Longmont, CO.
13. 2001, 3/22-23: Quantum Corporation, Shrewsbury, MA.
14. 2000, 7/11: Quantum Corporation, Milpitas, CA.
15. 2000, 7/17: 29th Annual Symposium, Incremental Motion Control Systems and Devices.
16. 2000, 8/29: Hitachi Corporation, Odawara, Japan.
17. 2000, 9/14-9/15: Quantum Corporation, Shrewsbury, MA.
18. 2000, 11/30-12/1: Quantum Corporation, Milpitas, CA.
19. 1999, 3/23: Quantum Corporation, Milpitas, CA.
20. 1999, 3/26: Seagate Technology, Oklahoma City, OK.
21. 1999, 5/6: Seagate Technology, Longmont, CO.
22. 1999, 5/13: Maxtor Corporation, Longmont, CO.
23. 1999, 6/7: Seagate Technology, Bloomington, MN.
24. 1999, 6/22: Quantum Corporation, Shrewsbury, MA.
25. 1999, 7/26: 28th Annual Symposium, Incremental Motion Control Systems and Devices.
26. 1999, 8/30-8/31: Quantum Corporation, Milpitas, CA.
27. 1998, 7/23: 27th Annual Symposium, Incremental Motion Control Systems and Devices.
28. 1998, 11/11: Quantum Corporation, Shrewsbury, MA.

INVENTION DISCLOSURES

1. Henry Bittner and I. Y. Shen: Tuned Air Bearing Damping Device for Vibration Reduction of Plate-like Structures, OTT Ref#2131-2960.

2. Liwei Lin, I. Y. Shen, and C. -P. Roger Ku: MEMS Sensors for Disk/Head Interfacial Contacts Characterizations, OTT Ref#2392-3022.
3. I. Y. Shen and Guozhong Cao: Extra-Sensitive PZT-Based Mechanical Transducers Using Nanorods, OTL Ref# 2799-3905, disclosed on February 21, 2003.
4. I. Y. Shen and Guozhong Cao: Extra-Sensitive Biological and Chemical Sensors Using Nanorods, OTL Ref# 2799-3906, disclosed on February 21, 2003.
5. I. Y. Shen and Guozhong Cao: Micromixers Using Nanorods, OTL Ref# 2799-3904, disclosed on February 25, 2003.
6. Chaw-Wu Tseng, Jr-Yi Shen, and I. Y. Shen: A Unified Algorithm to Compute Vibration of Rotating Machines, disclosure number 3933, disclosed on March 5, 2003; provisional patented filed on March 27, 2003.
7. I. Y. Shen: A Unified Algorithm to Compute Vibration of Asymmetric Rotating Machines, OTL Ref#: 3059-4042, disclosed filed in October 2003, provisional patent file in November 2003.
8. Clifford Hume, I. Y. Shen, and Guozhong Cao: Hybrid Cochlear Implants, UW TechTransfer DL Reference No. 4146, disclosed on March 2, 2004.
9. Clifford Hume and I. Y. Shen: Active Incudo-Stapedial Prosthetic Joints, UW TechTransfer Reference No. 7092D, disclosed on August 4, 2004.
10. Hsien-Lin Huang, Guozhong Cao, Naji Al Dahoudi, and I. Y. Shen, "Methods to Make Lead-Zirconium-Titanium Oxide (PZT) Ink," provisional patent filed on July 10, 2012 with serial number 61/669,986

PATENTS

1. I. Y. Shen, Chaw-Wu Tseng, Jr-Yi Shen, United States Patent No. 7,630,869, issued on December 8, 2009, "Method for predicting vibrational characteristics of *rotating* structure."
2. Jeff Duce, Scott Johnston, I. Y. Shen, G. Z. Cao, Hsien-Lin Huang, "Method and System of Fabricating PZT Nanoparticle Ink Based Piezoelectric Sensor. United States Patent No. 8,614,724, issued on December 24, 2013.
3. Hsien-Lin Huang, G. Z. Cao, I. Y. Shen, "Methods for forming Lead Zirconate Titanate Nanoparticles," U.S. Patent Number 9,005,465, issued on April 14, 2015.
4. I-Yeu Shen, John A. Sorensen, Naseeba Khouja, and Wei Che Tai, "Methods and Systems to Measure and Evaluate Stability of Medical Implants." Granted in US/EU/JP/KR/CN. US11944452B2 (2024), EP3592227B1 (2020), JP7288670B2 (2023), KR102468226B1 (2022), CN110582230B (2022).
5. Weiwei Xu, Darwin S. Wood, Y. Liu, and I. Y. Shen, "Methods and Devices to Measure Angular Stiffness of Dental and Medical Implants," WIPO PCT Application, WO2022187080A1, PCT/US2022/017795, US Patent Application 18/547,897 filed 8/25/2023.
6. I-Yeu Shen and Zi Ye, "SENSOR UNITS FOR USE WITH A MEDICAL IMPLANT STABILITY ANALYZING SYSTEM, AND RELATED SYSTEMS AND METHODS," WIPO PCT Application WO2024206009A1, filed 3/26/2024.

7. I-Yeu Shen, Yifeng Liu, Johnny Wang, Weiwei Xu and Michel Dard, "DENTAL IMPLANT STABILITY ANALYZERS," US Provisional patent Application 63/705,273 filed 10/9/2024.

LITIGATION EXPERIENCE

Expertise Areas: hard disk drives, optical drives, electrical motors, haptic/vibration feedback, game controllers, dental devices (e.g., dental drills, ultrasonic dental scalers, implant stability testing devices, dental implants and prosthesis), medical devices (e.g., ultrasonic surgical knives/scalpels/aspirators, surgical drills, hearing aids, cochlear implants), rotary machines (e.g., machine tools, compressors, turbines, motors, flywheels, propellers, bearings, seals, balancing), mechanical fastening mechanisms (e.g., chucks, collets, fasteners, clips, dovetails, latches), electrical connectors (e.g., surface mount joints), vibration sensors, piezoelectric sensors and actuators (e.g., anti-slip yaw-rate sensors for automobiles, piezo thin film sensors, stack actuators, PZT nano-particles and composites), audio systems (e.g., speakers, microphones), autonomous flying vehicles (e.g., drones, flapping-wing robots), failure analysis, vacuum technology, instrumentation, shock, dynamics, vibration, and damping technology.

Cases Participated:

1. DLA Piper, 09/2023-08/2024: HTI v Suncall. Expert witness on litigation matters related to four patents involving hard disk drive suspension systems. (References: Robert Buergi and Jon Ikegami).
2. Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, 02/2021-10/2021: Nidec Corporation v Seagate Technology LLC et al. Expert witness on litigation matters related to three patents involving motors. (Reference: Benjamin Schlesinger).
3. Latham & Watkins and Fish & Richardson, 05/2017-05/2018: expert witness on litigation matters related to a patent involving motors. Major duties include technical analyses and an expert report.
4. Kirkland and Ellis (Chicago, IL), 08/2016-05/2017: expert witness on arbitration matters related to a patent involving computer interface devices for SONY. Major duties include technical analyses, an expert report, deposition, and testifying in the final hearing. (References: Gregory Arovas, David Rokach, and Brandon Brown).
5. Thomson Reuters Expert Witness Services, 12/2012-04/2017: expert witness on a patent case involving rotary mechanics of optical drives for LG. Major duties include technical analyses, an expert report, and deposition for IPR. (References: Jason M. Shapiro and Brian Tollefson).
6. Kelly, Goldfarb, Huck & Roth, PLLC (Seattle, WA) for *Ramgen Power Systems, LLC v. Agilis Engineering, Inc*., 01/2014-10/2014: retained as an expert witness for litigation matters related to failure of a turbo machinery test rig. Major duties include technical analyses, an expert report, deposition, and testifying in US District Court at Seattle. (References: Kith Roth, Chris Huck, and Michael Goldfarb)
7. Intelligent Management Solutions (Denver, CO.): 12/2012–03/2013: expert consultant for disk drive head and disk testers for Guzik vs. Western Digital Corporation.
8. Lane Powell (Seattle, WA) for *Hayes vs. Marlow Yachts Limited Inc*., 01/2011-05/2011: retained as a consulting expert.
9. Kirkland and Ellis (New York, NY), 03/2011: technical analysis for potential litigation matter, (reference: Andrew G. Heinz).

10. Silicon Valley Expert Witness Group, 04/2010-06/2010: expert consultant on disk drive actuators, shock sensors, and servos.
11. Amster, Rothstein, and Ebenstein (New York, NY) for *Nidec vs. JVC*, 03/2005-12/2007: retained as a testifying expert in patent infringement litigations involving disk drive spindle motors. Major duties include technical advice, depositions, written reports, and court tutorial for litigation, (reference: Charley Macedo).
12. Intelligent Management Solutions (Denver, CO.): expert consultant for disk drive spindle motors, February to December 2004.

PROFESSIONAL CONSULTING EXPERIENCE

1. Nakanishi Inc. (Japan), 06/2016-06/2020: consultant on dental and medical equipment, motors, and ultrasonic devices.
2. Industrial Technology Research Institute (Taiwan), 04/2012-12/2013: consultant on system modeling, robotics, sensors, actuators, and piezoelectric devices.
3. TDK (Japan), 01/2010-09/2015: consultant on piezoelectric thin-film MEMS.
4. Seagate Technology (Longmont, CO.): consultant on spindle motors, May 2000, April 2001, May 2002.
5. Universal Avionics Systems Corporation (Redmond, WA.): consultant on acoustics, 12/00-1/01.
6. Midwest Dental Products (Des Plaines, IL.): consultant on spindle dynamics of dental drills, 3/00 – 6/00.
7. SAE Magnetics (Beaverton, OR.): consultant on spindle motors, February 1998.

ACADEMIC ADVISING ACTIVITIES

A. Postdoctoral Fellows (Total 5):

1. Dr. Chuan Luo, 01/2013 – 07/2013. Conducted animal tests of PZT thin-film microactuators.
2. Dr. Wei Che Tai, 11/2014 - 07/2016. Conducted research added mass, snap-through of PZT micro-actuators, and nondestructive testing of dental implants.
3. Dr. Mark A. Jankauski, 04/2017-07/2017. Conduct research on insect flight dynamics.
4. Mr. Yifeng Liu, 01/2019-08/2019. Conduct research on spinning cyclic symmetric spindle vibration, dental implant stability tester, and novel applications of PZT thin-film micro-actuators.
5. Ms. Weiwei Xu, 05/2020-11/2021. Conduct research on organic piezoelectric thin-film sensors on flexible substrates via 3D printing.

B. Current PhD Students (Total 1):

1. Mr. Kyle Miller, ME, PhD student, admitted in Spring 2023. Thesis research: Mechanics of dental implants with prosthetic structures.

C. Current MS Students with Thesis (Total 0):

D. Former PhD Students (Total 24):

1. Mr. Hsin-Chih Ping, PhD, ME, graduated 12/97. Thesis Title: Vibration of Euler-Bernoulli beams containing an oblique crack (retired as a full professor of Chung-Cheng Institute of Technology, Taiwan).
2. Mr. Yeun-Seuk Jeung, PhD, AA, graduated 6/98. Thesis Title: A finite element formulation of constrained layer damping treatments for shells, (retired as senior manager of Korean Aerospace Industries, LTD, Seoul, Korea).
3. Ms. Thitima Jintanawan, PhD, ME, graduated 5/00. Thesis Title: Free and forced vibration of rotating disk/spindle systems supported by fluid-film bearings, (currently associate professor in Chulalongkorn University, Thailand).
4. Mr. Yao-Hsing (Peter) Huang, PhD, ME, graduated 9/00. Thesis Title: Some fundamental issues of constrained layer damping treatments, (started as a mechanical engineer in Western Digital Corporation, now in private sector).
5. Mr. Jr-Yi Shen, PhD, ME, graduated 6/02. Thesis Title: Effect of base plate flexibility on vibration of disk/spindle systems, (started in mechanical engineer in Hitachi Global Storage Technologies, now at Apple).
6. Mr. Chaw-Wu Tseng, PhD, ME, graduated 8/02. Thesis Title: Theoretical and experimental study of hydrodynamic spindles: rotating-shaft design, (started as mechanical engineer at Western Digital Corporation, now in private sector).
7. Mr. Jung Seo Park, ME, PhD, graduated 6/03. Thesis Title: Effects of asymmetry on rotating disk and spindle systems, (started at Hitachi Global Storage Technologies, currently unknown).
8. Mrs. Yi-Chu Hsu, ME, PhD, graduated 6/03. Thesis Title: Passive and Active Damping Treatments for Microstructures, (currently full professor of Southern Taiwan Institute of Technology.)
9. Ms. Jessica Yellin, ME, PhD, graduated 6/04. Thesis Title: Vibration analysis of passive standoff constrained layer damping treatments, supported in part by IBM fellowship and ARO grant DAAG55-98-1-0387. (retired.)
10. Mr. Behko Heo, ME, PhD, graduated in 6/04. Thesis Title: Enclosure design of high-speed rotating disk/spindle systems: aerodynamic and structural considerations, supported in part by IDEMA Fellowship, NSF grant CMS-9820745, and Western Digital interns, (senior manager at Western Digital).
11. Mr. Chia-Che Wu, ME, PhD, graduated in 6/06. Thesis Title: Development of PZT Thin-Film Microactuators, (currently associate professor of Chung-Hsing National University, Taiwan.)
12. Mr. Jungkeun Yoon, ME, PhD graduated in June 2008. Thesis Title: Vibration of Rotating Disk/Spindle Systems with Nonlinear Bearings. (lost contact.)
13. Tsung-Liang Wu, PhD in ME, graduated in December 2008. Thesis research: Vibration Analysis of a Data Storage Device Consisting of a Spinning Disk-Spindle Assembly, a Stationary Housing, and a Swinging Flexible Structure Assembly, (currently associate professor and department chair of National Kaohsiung University of Science and Technology).
14. Cheng-Chun (Ryan) Lee, PhD in ME, graduated in March 2009. Thesis Title: Development of PZT Thin-Film Membrane Actuators, (lost contact, last worked in TDK.)
15. Hyunchul Kim, PhD in ME, graduated in June 2009. Thesis Title: Vibration of Spinning Asymmetric Rotors, (started at Western Digital, now deceased.)

16. Mr. Qing Guo, PhD in ME, graduated in August 2012. Thesis Title: Development of Thin-Film Based Microdevices and Process Enhancement for Making the Same. (currently in Microsoft.)
17. Mr. Chuan Luo, PhD in ME, graduated in December 2012. Thesis Title: PZT Thin Film Micro Probe Device with Dual Top Electrodes. (currently associate professor at National Tsinghua University, Beijing, China)
18. Mr. Wei-Che Tai, ME PhD student, graduated in June 2014. Thesis Title: Vibration of a spinning, cyclic symmetric rotor Assembled to a flexible housing via multiple bearings, (currently assistant professor at Michigan State University)
19. Ms. Ya-Fang Chen, ME, PhD, graduated in June 2016. Thesis research: Effects of bearings on vibration of cyclic symmetric rotors with mistune, (started at Hitachi Global Storage Technologies, currently unknown.)
20. Mr. Mark Jankauski, ME, PhD, graduated in March 2017. Thesis title: Dynamic Modeling of Insect Flight Mechanisms, (currently assistant professor at Montana State University).
21. Mr. Yifeng Liu, ME PhD, graduated in December 2018. Thesis research: PZT thin-film microactuators for intracochlear applications, (currently CEO of Quiver Dental, Inc.)
22. Ms. Weiwei Xu, ME PhD, graduated in June 2019. Thesis research: Piezoelectric Nano-Composite thin-film sensors using lead-zirconate-titanate nano-particles, (currently postdoc at UW).
23. Mr. Sergiy Taylakov, ME, PhD, graduated in December 2020. Thesis research: Fluid-Structure Interaction Between a Piezoelectric Microactuator and a Flexible Membrane in a Fluid Channel, (Currently at Oscilla Power).
24. Ms. Samantha Hoang, ME, PhD student, graduated in Summer 2022. Thesis research: Modeling flight dynamics of high-payload and high-endurance drones. (Currently an assistant professor at Seattle University).
25. Mr. Kyle Miller, ME, PhD student, admitted in Spring 2023. Thesis research: Mechanics of dental implants with prosthetic structures.

E. Former MS Students with Thesis (Total 15):

1. Mr. Yingdong Song, MSEM, graduated 11/93. Thesis title: Stability and vibration of a rotating circular plate under stationary in-plane edge loads (currently in Centurion Internation, Lincoln, NE).
2. Mr. Weili Guo, MSEM, graduated 5/94. Thesis title: Torsional vibration control of a circular shaft through intelligent constrained layer damping treatments (currently in ALMO Manifold & Tooling, Warren, MI).
3. Mr. Robert Hildebrand, MSEM, graduated 5/94. Thesis title: Hybrid damping of transverse beam vibration by an in-plane treatment (currently in Instituite for Farkostteknik, Stockholm, Sweden).
4. Mrs. Carina Ting, MSME, graduated 12/95. Thesis Title: Solutions to the vibration-acoustic response of strip structures subjected to various excitations (previously supported in part by NSF grant MSS-9496149; currently in Cambridge Acoustical Associates, Cambridge, MA).
5. Mr. Paul Brown, MSME, graduated 8/96. Thesis Title: Self-sensing active constrained layer damping of a nonlinear beam (previously supported by Royal Research Fund; currently manager of Adroit Systems, Seattle, WA).
6. Ms. Jessica Yellin, MSME, graduated 8/96. Thesis Title: An experimental analysis of a self-sensing active constrained layer damping treatment (previously supported by NSF grant MSS-9496149; currently in UW PhD Program).

7. Mr. Matt Shumway, MSME, graduated 6/97, Thesis Title: An Experimental Study of Damping in a Rotating Disk and Spindle System, (previously supported by Conner Peripherals and NSF grant CMS-9634557; currently in Seagate Technology, Bloomington, MN.).
8. Mr. Alex Tsay, MSME, graduated 6/98. Thesis Title: Theoretical and experimental analysis of vibration characteristics of glide heads for computer hard disk drives, (previously supported in part by Seagate intern and co-op; currently in Western Digital Corporation, San Jose, CA).
9. Mr. Henry Bittner, MSME, graduated 8/98. Thesis Title: The effect of air on disk drive dynamics and the taming of disk drive vibration, (previously supported in part by NSF grant CMS-9634557, currently in Response Dynamics, Oakland, CA.).
10. Mr. Behko Heo, MSME, graduated 3/99. Thesis Title: Experimental investigation of disk/spindle systems with laminated disks, (previous supported in part by Seagate intern, currently in UW PhD program).
11. Ms. Jin-Hui Ou-Yang, MSME, graduated 9/99. Thesis Title: Frequency response functions of PZT glide heads, (previously supported by NSF grant CMS-9800180 and in part by Seagate intern; currently in Western Digital Corporation, San Jose, CA.).
12. Mr. Seungman (Paul) Chang, MSME, graduated 6/00. Thesis Title: Disk/head interfacial contacts in glide tests, (previously supported by NSF grant CMS-9800180; currently in Western Digital Corporation, San Jose, CA.).
13. Mr. Richard Kent, ME, graduated 6/02. Thesis Title: Response of rotating disk/spindle systems subjected to rocking excitations. Currently at Xerox Corporation.
14. Mr. Hyunchul Kim, ME, graduated 6/03. Thesis Title: Verification of a unified rotordynamics analysis by use of rotating cylinders.
15. Mr. Mark Jankauski, ME, graduated in 06/14. Thesis research: Coupled Dynamics Between Flapping Wings and Vibrating Thorax During Insect Flight.

F. Former and Current Undergraduate Researchers (Total 26):

1. Mr. Clint VanderGiesen, ME, undergraduate senior. Research topic: Effect of ball bearing defects on rocking vibration of rotating disk and spindle systems (supported by NSF grant CMS-9820745).
2. Ms. Wina Wichienwidhtaya, ME, graduated 6/01. Research topic: Vibration isolation of rotating disk/spindle systems through damped spacers (supported by NSF grant CMS-9820745), 12/16/99-3/15/00 and 9/16/00-12/15/00.
3. Mr. Jason Dahlem, ME, graduated 6/00. Research topic: Frequency response of rotating disk/spindle systems subjected to rocking excitations (supported by NSF grant CMS-9820745), 3/16/00-6/15/00.
4. Mr. Richard Kent, ME, graduated 3/00. Research topic: Vibration isolation of rotating disk/spindle systems (supported by NSF grant CMS-9820745), 12/16/99-3/15/00.
5. Mr. Shalom Ruben, ME, undergraduate senior. Research topic: Instrumentation and testing of spindle systems at elevated temperature (supported by REU of NSF grant CMS-9634557), 9/16/98-6/15/99.
6. Ms. Monica Williams, ME, undergraduate senior. Research topic: Instrumentation of impact force hammer for disk drive applications (supported by REU of NSF grant CMS-9800180), 12/16/98-6/15/99.

7. Ms. Jessica Bowen, ME, undergraduate senior. Research topic: Experimental and theoretical study of spinning cylinder mounted on hydrodynamic spindle motors (supported by REU of NSF grant CMS-0244116), 9/16/2003-6/15/2004.
8. Ms. Melinda Herrin, ME, undergraduate senior. Research topic: Experimental and theoretical study of spinning cylinder mounted on hydrodynamic spindle motors (supported by REU of NSF grant CMS-0244116), 9/16/2004-6/15/2005.
9. Mr. Nicholas Colonnese, ME, undergraduate senior. Research topic: Waterfall plot measurements of a spinning cyclic symmetric rotor on flexible bearings. 6/16/08-8/31/08. Intel REU.
10. Ms. Alexia Fisher, ME, undergraduate senior. Research topic: Effects of electrode arrangements in PZT thin-film sensors and actuators. 9/16/08-6/15/2009. NSF REU.
11. Alicia Tan, ME, undergraduate senior. Research topic: Fabrication of PZT thin films using calibrated pyrolysis in sol-gel process. 12/16/09-6/15/10. NSF REU.
12. Cassius Elston, ME, undergraduate senior. Research topic: Effects of slots on displacement enhancement of PZT thin-film microactuators. 09/16/10-6/15/11. NSF REU.
13. Mckenzie Staley, ME undergraduate senior. Research topic: Development of test rigs to calibrate sensitivity of PZT thin-film diaphragm micro-sensors. 6/16/2012-06/15/2013, NSF REU.
14. Samuel Wallen, ME undergraduate senior. Research topic: Self-sensing acoustic actuator via a dual-electrode design. 11/16/2012-06/15/2013, NSF hourly.
15. Dana I. Fraij, ME undergraduate senior. Research topic: Characterization of a PZT disk bender for tactile sensing. 6/16/2015-9/15/2015. NSF REU.
16. Ziwen Guo, ME undergraduate junior. Research topic: dynamics of flapping wings. 9/15/2015-6/15/2017.
17. Philip A. Walczak, BioE undergraduate senior. Research topic: development of a hand tool to measure dental implant stability. 3/16/2016-6/15/2017
18. Melanie Wullaert, ME undergraduate senior. Research topic: development of a hand tool to measure dental implant stability. 3/16/2017-6/15/2018.
19. Kailing Zhu, ME undergraduate senior. Research topic: Vibration of spinning asymmetric spindles at high speed. 6/16/2017-6/15/2018.
20. Heng Zhu, ME undergraduate senior, Tsinghua University, China. Research topic: Geometry considerations of alpine touring Tech/Pin systems. 2/1/2018-6/15/2018.
21. Zi Ye, ME undergraduate senior. Research topic: Development of a handheld dental implant stability tester. 6/16/2018-3/15/2019
22. Wade Marquette, ME undergraduate senior. Research topics: Vibration of spinning cyclic symmetric rotors and ultrasound cutting of bones. 10/16/2018-6/15/2019
23. Jeffrey Jacobsen, ME undergraduate senior. Research topics: Experimental studies of alpine touring Tech/Pin systems. 10/16/2018-6/15/2019
24. Peter Tsanev, ME undergraduate senior. Research topics: Optimization of motor grouping to reduce energy expenditure of multi-rotor drones. 9/15/2020-12/15/2020.
25. Nolan K. Shinn, ME undergraduate senior. Research topics: Influence of flight trajectories on energy expenditure of multi-rotor drones. 9/15/2020-12/15/2020.

26. Eva R. Soegiantoro, ME undergraduate senior. Research topics: Finite element analysis of a dental implant stability testing device. 9/15/2020-03/15/2021.
27. Jihai Zhou, ECE undergraduate senior. Research topics: Prototype development of a dental implant stability analyzer involving BLDC motors and g-sensors. 5/1/2022-03/15/2023.

F. ME 499 Special Projects (Total 3):

1. Mr. Kim Gerald, Winter Quarter, 1998; design of automatic transmission systems for bicycles.
2. Mr. Patrick Dean, Winter and Spring Quarters, 1996; design of disk brakes for bicycles.
3. Mr. Richard Chu, Winter and Spring Quarters, 1995; piezoelectric actuators for plates.

TEACHING ACTIVITIES AT UW

A. Undergraduate Courses Taught

1. ME 230 -- Kinematics and Dynamics
2. ME 373 -- Introduction to System Dynamics
3. ME 374 -- System Dynamics Analysis and Design
4. ME 470 – Mechanical Vibration

B. Graduate Courses Taught

1. ME 564 -- Mechanical Engineering Analysis I
2. ME 565 -- Mechanical Engineering Analysis II
3. ME 588 -- Dynamics and Vibration
4. ME 589 -- Vibrations I (Nonlinear Vibration)
5. ME 590 -- Vibrations II (Random Vibration)
6. ME 599 X -- Damping in Vibratory Systems

C. Curriculum Development and Modification

1. Published 550 pages of typeset notes for ME 373 and ME 374 (System Dynamics) to serve as a textbook for the class.
2. Published 270 pages of typeset notes for ME 588 (Dynamics and Vibration) to serve as a textbook for the class.
3. Published 350 pages of typeset notes for ME 230 (Kinematics and Dynamics) to serve as a textbook for the class.
4. Revised curriculum of ENGR 230 (Kinematics and Dynamics) in Autumn 1995 and Spring 1996. Developed pretests and tutorials for cooperative learning in classroom.
5. Developed a new graduate course ME 599 X Damping in Vibratory Systems offered in the Spring Quarter of 1995 and 1997. 15 students were enrolled in 1995 and 14 in 1994.

D. Teaching Evaluations – Undergraduate Courses (Out of a 5.0 Scale)

Courses				Evaluations (out of 5.0)	
Number	Name	Year	No. of Students (Respondents)	Instructor's Contribution	Teaching Effectiveness
ME 230	Kinematics and Dynamics	Sp 25	251(43)	4.8	4.6

ME 460	Kinematics/Linkage Design	W 25	38(7)	5.1	5.2
ME 230	Kinematics and Dynamics	Sp 24	214(41)	4.5	4.4
ME 230	Kinematics and Dynamics	Sp 23	209(49)	4.7	4.3
ME 374	System Dynamics II	Sp 22	164(55)	5.3	5.2
ME 373	System Dynamics I	W 22	163(41)	5.2	5.2
ME 374	System Dynamics II	Sp 20	157(51)	5.0	5.0
ME 373	System Dynamics I	W 20	157(36)	5.2	5.2
ME 373	System Dynamics I	W 19	158(36)	5.2	5.2
ME 374	System Dynamics II	Sp 18	177(50)	5.2	5.3
ME 373	System Dynamics I	W 18	172(75)	5.2	5.2
ME 230	Kinematics and Dynamics	Sp 17	267(155)	4.9	4.9
ME 374	System Dynamics II	Sp 16	158(44)	4.7	4.6
ME 373	System Dynamics I	W 16	153	5.1	5.1
ME 230	Kinematics and Dynamics	W 15	162	5.1	5.0
ME 373	System Dynamics I	W 14	140	4.9	4.7
ME 230	Kinematics and Dynamics	Sp 13	175	4.9	4.7
ME 374	System Dynamics II	Sp 12	123	4.8	4.9
ME 230	Kinematics and Dynamics	Sp 11	162	5.0	5.0
ME 230	Kinematics and Dynamics	Sp 10	159	3.5	3.5
ME 374	System Dynamics II	Sp 08	94	5.1	5.2
ME 373	System Dynamics I	W 08	95	5.0	5.0
ME 230	Kinematics and Dynamics	Sp 07	135	4.8	4.7
ME 374	System Dynamics II	Sp 06	99	5.1	5.1
ME 373	System Dynamics I	W 06	100	4.9	5.0
ME 230	Kinematics and Dynamics	Sp 05	128	4.8	4.8
ME 374	System Dynamics II	Sp 04	53	4.9	4.8
ME 373	System Dynamics I	W 04	70	4.8	4.7
ME 230	Kinematics and Dynamics	Sp 03	161	5.0	5.0
ME 470	Mechanical Vibration	A 02	18	4.50	3.50
ME 230	Kinematics and Dynamics	Sp 02	130	4.30	4.40
ME 470	Mechanical Vibration	A 01	18	4.50	4.19
ME 374	System Dynamics II	W 01	58	4.88	4.85
ME 373	System Dynamics I	A 00	57	4.85	4.80
ME 230	Dynamics	Sp 00	68	4.55	4.41
ME 374	System Dynamics II	W 00	52	4.96	4.83
ME 373	System Dynamics I	A 99	45	4.77	4.67
ME 374	System Dynamics II	Sp 99	35	4.18	4.13
ENGR 230	Kinematics and Dynamics	Sp 98	101	4.67	4.61

ME 374	System Dynamics II	Sp 98	66	4.67	4.39
ME 373	System Dynamics I	W 98	49	4.86	4.87
ENGR 230	Kinematics and Dynamics	A 97	49	4.79	4.76
ENGR 230	Kinematics and Dynamics	Sp 97	88	4.86	4.80
ME 373	System Dynamics I	W 97	58	4.5	4.4
ENGR 230	Kinematics and Dynamics	Sp 96	Development – No Evaluation Data		
ENGR 230	Kinematics and Dynamics	A 95	Development – No Evaluation Data		
ENGR 230	Kinematics and Dynamics	W 95	41	4.83	4.78

E. Teaching Evaluations – Graduate Courses (Out of a 5.0 Scale)

Courses				Evaluations (out of 5.0)	
Number	Name	Year	No. of Students (Respondents)	Instructor's Contribution	Teaching Effectiveness
ME 588	Dynamics & Vibration	A 24	49(18)	4.8	4.7
ME 588	Dynamics & Vibration	A 23	32(10)	4.9	4.6
ME 588	Dynamics & Vibration	A 22	41	4.9	4.7
ME 588	Dynamics & Vibration	A 21	55	4.8	4.7
ME 588	Dynamics & Vibration	A 20	60	4.9	4.8
ME 588	Dynamics & Vibration	A 19	45	5.1	5.1
ME 588	Dynamics & Vibration	A 18	41	4.5	4.4
ME 588	Dynamics & Vibration	A 17	32	4.9	4.7
ME 589	Vibration I	W 17	8	3.9	4.0
ME 588	Dynamics & Vibration	A 16	28	4.5	4.8
ME 588	Dynamics & Vibration	A 15	28	4.9	4.9
ME 588	Dynamics & Vibration	A 14	41	4.5	4.4
ME 588	Dynamics & Vibration	A 13	28	4.5	4.5
ME 589	Vibration I	W 13	11	4.7	4.3
ME 588	Dynamics & Vibration	A 12	37	4.8	4.7
ME 588	Dynamics & Vibration	A 11	7	4.5	4.5
ME 588	Dynamics & Vibration	A 10	30	4.8	4.7
ME 588	Dynamics & Vibration	A 09	22	4.4	4.3
ME 588	Dynamics & Vibration	A 08	10	4.6	4.6
ME 588	Dynamics & Vibration	A 06	17	4.5	4.6
ME 588	Dynamics & Vibration	A 05	20	4.5	4.3
ME 588	Dynamics & Vibration	A 03	13	4.10	3.50
ME 588	Dynamics & Vibration	W 03	18	4.10	4.10
ME 589	Vibration I	W 02	12	4.41	4.39

ME 588	Dynamics & Vibration	A 01	15	4.35	4.15
ME565	Engineering Analysis II	W 99	30	4.86	4.73
ME 564	Engineering Analysis I	A 98	30	4.81	4.34
ME 588	Dynamics & Vibration	A 98	10	4.94	4.88
ME 599X	Vibration Damping	Sp 97	14	4.91	4.69
ME 588	Dynamics & Vibration	A 96	25	4.8	4.7
ME 565	Engineering Analysis II	W 96	29	4.8	4.8
ME 599H	Vibration Damping	Sp 95	9(3)*	5.0(4.67)	4.89(4.67)
ME 588	Dynamics & Vibration	A 94	13	4.75	4.50
ME 590	Vibration II	Sp 94	5(2)*	4.5(3.5)*	4.5(3.5)*
ME 589	Vibration I	W 94	7(2)*	4.86(5.0)*	4.71(5.0)*

* The numbers in parentheses are from distant learning students

F. Collegial Evaluation of Teaching Effectiveness

1. ME 374 – System Dynamics Analysis and Design, Winter Quarter, 2000

   Conclusion: There is very little that the committee can add to the foregoing. Professor Shen is clearly a gifted teacher. Although he does not mention it, he has acted as an informal teaching mentor and coach to various faculty who are either new to the University or are attempting changing their teaching. His success in the face of a heavy teaching load and challenging classes is testimonial to his skills and the hard work he devotes to his students.

2. ENGR 230 -- Kinematics and Dynamics, Winter Quarter, 1995

   Conclusion: Professor Shen is an effective teacher in both undergraduate and graduate instruction. The overwhelming enthusiasm of the responses by his students indicates that he is a gifted educator.

3. ME 589 -- Vibration I (Nonlinear Vibration), Winter Quarter, 1994

   Conclusion: Professor Shen is an effective instructor at the graduate course level. The overwhelming enthusiasm of the responses by his students in the student evaluation indicates that he is a gifted educator. One can only assume on the basis of this single review that he will be as effective in his conduct of undergraduate courses.

PROFESSIONAL SERVICES

A. External Services

1. Technical Editor, ASME *Journal of Vibration and Acoustics*, 3/1/2014-12/31/2019.
2. Member of Advanced Research Advisory Committee, Industrial Technology Research Institute, Taiwan, 5/1/2016-4/30/2025.
3. Past Chair (10/1/2014-09/30/2016), Chair (10/1/2012-09/30/2014), Vice Chair (7/1/10-9/30/12), Secretary (7/1/08-6/30/10), and Member (7/1/03 – 6/30/08) of ASME Technical Committee of Vibration and Sound, Design Engineering Division.
4. Associate Editor, ASME *Journal of Vibration and Acoustics*, 6/15/2005-6/14/2012.

5. Conference Chair, 2006 ASME/ISPS-JSME/IIP Joint Conference on Micromechantronic Intelligent and Precision Equipment, San Jose, CA., USA, 6/21-23.
6. Guest Editor, *MIPE 2006 Special Issue*, *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*.
7. Member of the Editorial Board of *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*, January 2002 – 2012.
8. Chair (7/07-6/08), Vice Chair (7/06-6/07) and Executive committee member (7/00 to 6/06) of ASME Information Storage and Processing System (ISPS) Division.
9. Review tenure and promotion cases for major research universities including: RPI (2000), Columbia University (2002), University of Maryland, College Park (2003, 2016), University of Pittsburg (2004), Northeastern University (2005, 2010, 2011), Chinese University of Hong Kong (2006, 2011), University of Illinois-Chicago (2006), Nanyang Technical University, Singapore (2007, 2008, 2016), University of Connecticut (2007, 2012), University of Michigan (2007, 2011), University of Washington (2007), University of Waterloo, Canada (2008, 2014). University of Tennessee (2010), University of Utah (2010), Stevens Institute of Technology (2010), UCLA (2010), Miami University (2010, 2013), Massey University, New Zealand (2010), National Central University, Taiwan (2012), Purdue University (2015), University of California, Santa Cruz (2016), New York University at Abu Dhabi 2016), University of British Columbia, Canada (2017), Binghamton University (2017, 2018), Bilkent University, Turkey (2018).
10. Co-organize the following conferences and workshops.
    - Annual Symposium of ASME Information Storage and Processing System (ISPS) Division held at San Jose, CA., from June 2001 to present, (Spindle motor sessions).
    - 3rd Asia-Pacific Magnetic Recording Conference held at Tokyo, Japan, 6-9 November, 2000, sponsored by IEEE and ASME, (Publicity Chair).
    - 2nd Asia-Pacific Magnetic Recording Conference held at Singapore, 29-31 July, 1998, sponsored by IEEE and ASME, (Organizer of Spindle Motor Session).
    - US-Japan Workshop on Smart Structures and Materials held in December 4-5, 1995 at the University of Washington with Professors Taya and Inoue, (Workshop Co-chair).
11. Served on the program committee of the following conferences.
    - International Symposium on Smart Structures and Microsystems, 2000, October 19-21, Hong Kong.
    - North American Conference on Smart Structures and Materials -- Passive Damping, 1998-2003
12. Review proposals for the following agencies and organizations since 1994.
    - National Science Foundation
    - National Institute of Health
    - Army Research Office
    - Natural Sciences and Engineering Research Council of Canada
    - Science and Engineering Research Council, Agency for Science, Technology and Research, Singapore (ASTAR)
    - Non-profit organizations (e.g., United States Civilian Research and Development Foundation).
13. Serve as a reviewer for the following journals from 1991 to present.
    - Sensors and Actuators A – Physical
    - IEEE Sensors Journal
    - ASME Journal of Applied Mechanics
    - ASME Journal of Vibration and Acoustics

- ASME Journal of Tribology
- ASME Journal of Dynamic Systems, Measurements, and Control
- IEEE Transaction on Magnetics
- IEEE/ASME Transaction on Mechatronics
- AIAA Journal
- STLE Tribology Transaction
- Journal of Sound and Vibration
- Journal of the Acoustical Society of America
- Journal of Smart Materials and Structures
- Shock and Vibration Journal
- International Journals of Solids and Structures
- Journal of Vibration and Control
- Journal of Intelligent Materials, Systems, and Structures
- Journal of Information Storage and Processing Systems

14. Serve as session chairmen of various ASME, IEEE, SPIE meetings since 1992. For example,
    - Spindle and actuator Session, ASME Information Storage and Processing System (ISPS) Conference, Santa Clara, CA., June 1999-2006, Sponsor by ASME.
    - Spindle Motor Session, 2nd Asia-Pacific Magnetic Recording Conference, Singapore, July 29-31, 1998, sponsored by IEEE and ASME.

B. Internal Services

1. Advisory Search Committee for the Dean of College of Engineering, 2019
2. Serve as the faculty Advisor of UW ASME Student Chapter, April 1997 to present.
3. Review proposals for Royal Research Funds.
4. Served on the following assignments of College of Engineering:
    - College Council: 9/16-8/22
    - Councils on Education Policies: 9/06-6/07
    - COE Open House: ME faculty coordinator, 1996
    - Student Affair Committee, 1999, vice chair.
    - COE restructuring, "Research and Facility" tiger team, 1999.
5. Serve on the following assignments of ME Department:
    - Strategic Planning Committee, 1999
    - Image Committee, 1999-present.
    - Faculty Search Committee: 1999 (Cooper), 1997 (Bill Amstrong), 2011 (Jonathan Posner).
    - SD&D Group Coordinator, 1997-1999, 2007-2009.
    - Undergraduate admission and scholarship committee, 1997-2007 (chair).
    - CETE (Collegial Evaluation of Teaching Effectiveness) Committee, 1996-present.
    - Undergraduate Education Committee, 1995-1996 (member), 2001-2007 (chair).
    - Graduate Program Coordinator, 09/2008-03/2012.
    - Promotion Advisory Committee, 2007-2010.

HONORS AND AWARDS

1. 2017: N. O. Myklestad Award, American Society of Mechanical Engineers

2. 2014: Best Paper Award, International Micro Air Vehicle Conference and Competition, Delft, The Netherlands, August 12-15, 2014, https://www.youtube.com/watch?v=S64kXAaT4lU
3. 2009: Valued Reviewer, Sensors and Actuators A -- Physical
4. 2008: Fellow, American Society of Mechanical Engineers
5. 2007: Distinguished Guest, Data Storage Institute, Singapore
6. 2004: ME Outstanding Faculty of the Year Award
7. 2003: ME Outstanding Faculty of the Year Award
8. 1998: ME Outstanding Faculty of the Year Award
9. 1998: IBM Partnership Award
10. 1994: Research Associate of AFOSR Summer Research Program

REFEREED ARCHIVAL JOURNAL PAPERS

1. I. Y. Shen and C. D. Mote, Jr., 1991: On the Mechanisms of Instability of a Circular Plate Under a Rotating Spring-Mass-Dashpot System, *Journal of Sound and Vibration*, Vol. 148, No. 2, July 1991, pp. 307-318.

2. I. Y. Shen and C. D. Mote, Jr., 1991: Parametric Resonances of a Circular Plate with Inclusions Subjected to a Rotating Spring, *Journal of Sound and Vibration*, Vol. 149, No. 1, pp. 164-169.

3. I. Y. Shen and C. D. Mote, Jr., 1992: Parametric Excitation Under Multiple Excitation Parameters: Asymmetric Plates Under a Rotating Spring, *International Journal of Solids and Structures*, Vol. 29, No. 8, 1992, pp. 1019-1032.

4. I. Y. Shen and C. D. Mote, Jr., 1992: Dynamic Analysis of Three-Dimensional, Finite, Linear, Elastic Solids with Kelvin Viscoelastic Inclusions: Theory with Applications to Asymmetrically Damped Circular Plates, *The Journal of the Acoustical Society of America*, Vol. 91, No. 3, March 1992, pp. 1489-1499.

5. I. Y. Shen and C. D. Mote, Jr., 1992: Modal Analysis of Kelvin Viscoelastic Solids Under Arbitrary Excitation: Asymmetric Plates Under a Rotating Transverse Force, *The Journal of the Acoustical Society of America*, Vol. 91, No. 5, May 1992, pp. 2703-2707.

6. I. Y. Shen and C. D. Mote, Jr., 1992: Dynamic Analysis of Three-Dimensional, Finite, Linear, Elastic Solids Containing Small Elastic Imperfections: Theory with Application to Asymmetric Circular Plates, *Journal of Sound and Vibration*, Vol. 155, No. 3, June 1992, pp. 443-466.

7. I. Y. Shen and C. D. Mote, Jr., 1992: Parametric Resonances of an Axisymmetric, Circular Plate Subjected to a Rotating Mass, *Journal of Sound and Vibration*, Vol. 152, No. 3, pp. 573-576.

8. I. Y. Shen, 1993: Response of a Stationary, Damped, Circular Plate Under a Rotating Slider Bearing System, *ASME Journal of Vibration and Acoustics*, Vol. 115, pp. 65-69.

9. I. Y. Shen, 1993: Vibration of Elastic Structures with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 414-421.

10. I. Y. Shen, 1993: Perturbative Eigensolutions of Elastic Structures with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 438-442.

11. I. Y. Shen and C. D. Mote, Jr., 1993: On the Mode Splitting of a Degenerate Elastic Structure with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 929-935.

12. I. Y. Shen, 1994: Vibration of Rotationally Periodic Structures, *Journal of Sound and Vibration*, Vol. 172, pp. 459-470.

13. I. Y. Shen, 1994: Hybrid Damping Through Intelligent Constrained Layer Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 116, pp. 341-349.

14. I. Y. Shen, 1994: Bending Vibration Control of Composite and Isotropic Plate Structures through Intelligent Constrained Layer Treatments, *Journal of Smart Materials and Structures*, Vol. 3, pp. 59-70.

15. I. Y. Shen, 1995: Vibration of a Three Dimensional, Finite, Linear, Elastic Solid Containing Cracks, *ASME Journal of Applied Mechanics*, Vol. 62, pp. 282-288.

16. I. Y. Shen, 1995: Bending and Torsional Vibration Control of Composite Beams Through Intelligent Constrained Layer Damping Treatments, *Journal of Smart Materials and Structures*, Vol. 4, pp. 340-355.

17. I. Y. Shen, 1996: Stability and Controllability of Euler-Bernoulli Beams with Intelligent Constrained Layer Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 118, pp. 70-77.

18. I. Y. Shen and Y. Song, 1996: Stability and Vibration of a Rotating Circular Plate Under Stationary In-plane Edge Loads, *Journal of Applied Mechanics*, Vol. 63, pp. 121-127.

19. C. -P. Roger Ku and I. Y. Shen, 1996: Effect of Disk Flexibility on Rocking Mode Frequencies of a Disk Drive Spindle Motor System, *STLE Tribology Transactions*, Vol. 39, No. 3, pp. 579-586.

20. Jessica M. Yellin and I. Y. Shen, 1996: A Self-Sensing Active Constrained Layer Damping Treatment for Euler-Bernoulli Beams, *Journal of Smart Materials and Structures*, Vol. 5, pp. 628-637.

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96. Y. F. Chen and I. Y. Shen, "Mathematical Insights of Mode Localization in Nearly Cyclic Symmetric Rotors with Mistune," ASME 25th Conference on Mechanical Vibration and Noise, Portland, OR, August 4-7, 2013, DETC2013-13223.

97. R. D. Manson and I. Y. Shen, "Preliminary Modeling of a Bio-Inspired Piezoelectric Microphone," ASME Seventh International Conference on Micro- and Nanosystems, Portland, OR, August 4-7, 2013, DETC2013-13645.

98. M. Jankauski and I. Y. Shen, "Dynamic Modeling of a Rotating Insect Wing," International Micro Air Vehicle Conference and Competition, Delft, The Netherlands, August 12-15, 2014. (Best paper award recipient.)

99. W. C. Tai and I. Y. Shen, "Experimental Verification of Ground-Based Response of a Spinning, Cyclic Symmetric Rotor Assembled to a Flexible Stationary Housing via Multiple Bearings," ASME 26th Conference on Mechanical Vibration and Noise, Buffalo, NY., August 17-20, 2014, DETC2014-34749.

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102. Chuan Luo, M. Staley, G. Z. Cao, and I. Y. Shen, "Sensitivity Calibration of a Lead-Zirconate-Titanate (PZT) Thin-Film Intracochlear Microphone," 14th World Congress in Mechanism and Machine Science, Taipei, Taiwan, 25-30 October, 2015.

103. M. Jankauski and I. Y. Shen, "Experimental Flapping Wing Strain Prediction using an Inertial-Elastic Model," International Micro Air Vehicle Conference and Competition, Aachen, Germany, September 15-18, 2015.

104. Yifeng Liu, G. Z. Cao, Clifford R. Hume, and I. Y. Shen, "Reliability and Lead Leaching of PZT Intracochlear Microactuators," Abstracts of 2017 *Conference on Implantable Auditory Prostheses*, July 16-21, Lake Tahoe, CA.

105. Weiwei Xu, G. Z. Cao, and I. Y. Shen, "Printed Lead-Zirconate-Titanate Thin Films for Hard Disk Drive Applications," Abstracts of Asia-Pacific Magnetic Recording Conference, November 15-17, 2018, Shanghai, China

106. Heng Zhu, Irving S. Scher, and I. Y. Shen, "Geometric Considerations for Alpine Touring Tech/Pin Systems," Abstracts of 23rd International Congress on Ski Trauma and Safety, April 7–13, 2019, Squaw Valley, California, USA.

107. Sergiy Taylakov and I. Y. Shen, "Experimental Study of Cochlear Dynamics with an Intracochlear Acoustic Micro-actuator," ASME 31st Conference on Mechanical Vibration and Noise, Anaheim, California, August 18 – 21, 2019, paper IDETC2019-97295

108. Samantha Hoang, Yifeng Liu, A. Aliseda, and I. Y. Shen, "Stability Analysis of High-Performance Drones with Suspended Payloads," ASME 31st Conference on Mechanical Vibration and Noise, Anaheim, California, August 18 – 21, 2019, paper IDETC2019-97947.

109. Samantha Hoang, Laurel Marsh, A. Aliseda, and I. Y. Shen, "Analysis of High-Fidelity Modeling of Drone Dynamics and Aerodynamics for Reduced Energy Consumption," ASME 32nd Conference on Mechanical Vibration and Noise, August 16-19, 2020, St. Louis, USA, paper IDETC2020-18581.

110. Samantha Hoang and I. Y. Shen, "Cost of Controls for Multi-rotor Drones," ASME 33rd Conference on Mechanical Vibration and Noise, virtual conference, August 17-19, 2021, paper IDETC2021-67816.

111. Samantha Hoang and I. Y. Shen, "Effects of Deterministic Gust Modeling for Large, Multi-Rotor Drones," ASME International Mechanical Engineering Congress & Exposition, October 29-November 2, 2023, New Orleans, LA, USA, paper IMECE2023-113645.

112. Weiwei Xu, Yen-Wei Chen, Kanako J. Nagatomo, Garrett Porter, Irving S. Scher, I. Y. Shen, "Use of a Flex Constant to Monitor Implant Stability in a Porcine Model," Academy of Osseointegration 2025 Annual Meeting, Seattle, WA., March 27-29, 2025.

BOOK CHAPTER

1. I. Y. Shen: An Introduction to Active Constrained Layer Damping Treatments, *Structronic Systems: Smart Structures, Devices, and Systems*, Editors: H. S. Tzou, G. L. Anderson, and M. C. Natori, World Science Publishing Company, Chapter 3, pp. 61-110, 1998, ISBN: 981-02-2955-0.

INVITED LECTURES

1. "Self-Sensing Active Constrained Layer Damping Treatments: Modeling, Simulation, and Experiments," University of California, Berkeley, CA., April 1996.
2. "Research on Rotating Disk/Spindle Systems at the University of Washington," IBM Almaden Research Center (San Jose, CA.), March 1997.
3. "Vibration and Damping Considerations in Computer Hard Disk Drives," 3M (St. Paul, MN.), June 1997.
4. "Vibration Control via Constrained Layer Damping: Modeling, Challenges, and Outlooks," IBM Almaden Research Center (San Jose, CA.), February 12, 1998.
5. "Disk Drive Spindle Vibration," Hong Kong University of Science and Technology, Hong Kong, China, August 1998.
6. "Vibration of Aluminum Disks in Computer Hard Disk Drives," Aluminum Company of America (Alcoa Technical Center, PA.), October 14, 1998.
7. "Research on Rotating Disk/Spindle Systems at the University of Washington," Data Storage Research Center, Carnegie Mellon University, (Pittsburg, PA.), October 15, 1998.
8. "Damping -- the Last Frontier," First ARO Damping Workshop, Virginia Tech., (Blacksburg, VA.), October 22, 1998.
9. "Disk Drive Spindle Dynamics," Hitachi Ltd. (Odawara, Japan), May 27, 1999.
10. "Disk Drive Spindle Dynamics and Servo Controls," Control and Robotics Colloquium, UW, April 7, 2000.
11. "Opportunities for MEMS in Computer Hard Disk Drives," Center of Applied Microtechnology, UW, April 20, 2000.
12. "Vibration of Disk Drive Spindles with Ball or Hydrodynamic Bearings," Colorado Institute of Storage Systems, University of Colorado, Boulder, CO., May 18, 2000.
13. "Vibration of Disk Drive Spindles with Ball or Hydrodynamic Bearings," Fujitsu, Kawasaki, Japan, November 10, 2000.
14. "Vibration of Rotating Disk and Spindle Systems," University of California, Los Angeles, March 8, 2001.
15. "Damping Treatments for Computer Hard Disk Drives," *International Workshop on Passive and Active Damping – Directions for the Next Decade*, Neu-Ulm, Germany, June 18-20, 2001.
16. "Vibration of Rotating Disk and Spindle systems," Shanghai Jiaotong University, Shanghai, China, August 30, 2002.
17. "Leadership through Innovation – My Academic Experience," Western Digital Corporation, May 15, 2003.
18. "Vibration of HDD Spindle Motors," Keynote speech for 2003 JSME-IIP/ASME-ISPS Joint Conference on Micromechatronics for Information and Precision Equipment, 6/15-18, 2003, Yokohama, Japan.
19. "A Unified Algorithm to Analyze Vibration of Rotating Machines," Pratt & Whitney, East Hartford, CT., September 24, 2003.

20. "A Unified Algorithm to Analyze Vibration of Rotating Machines," General Electrics Research Center, Schenectady, NY, September 25, 2003.
21. "A Unified Algorithm to Analyze Vibration of Rotating Machines," MSC.Software, Pasadena, CA., October 28, 2003.
22. "Vibration of Flexible Spinning Asymmetric Rotors," MSC.Software, Pasadena, CA., July 16, 2004.
23. "A Unified Algorithm to Analyze Vibration of Rotating Machines," National Cheng-Kung University, Tainan, Taiwan, August 23, 2004.
24. "PZT Thin-Film Sensors and Actuators: Applications to Biomedical Engineering," Mayo Clinic, Rochester, MN, September 9, 2005.
25. "Electrode Optimization of PZT Thin-Film Microactuators for Hybrid Cochlear Implants," 2007 *Conference on Implantable Auditory Prostheses*, July 15-20, Lake Tahoe, CA.
26. "Fundamentals of HDD Spindle Motor Dynamics," Data Storage Institute, Singapore, October 30, 2007.
27. "Present and Future Opportunities of HDD Spindle Vibration Research," Data Storage Institute, Singapore, November 1, 2007.
28. "PZT Thin-Film Micro-Devices for Biomedical Applications," National Chung-Hsing University, Taiwan, December 21, 2007.
29. "Vibration Analysis of Spinning Rotor Coupled with Flexible Housing," National Chung-Hsing University, Taiwan, December 20, 2007.
30. "PZT Thin-Film Microactuators for Combined Electric and Acoustic Stimulations," University of California, Los Angeles, March 6, 2009.
31. "Vibration Analysis of Spinning Rotors with Flexible Bearings and Housing Supports," Penn State University, State College, PA, March 23, 2010.
32. "Fundamentals of HDD Spindle Motor Dynamics," Data Storage Institute, Singapore, June 24, 2011.
33. "Vibration Analysis and Health Monitoring of Spinning Cyclic Symmetric Rotors with Flexible Bearing and Housing Supports," United Technology Research Center, East Hartford, CT, July 25, 2011.
34. "Development of an Acoustic Microactuator for Inner Ear Hearing Rehabilitation," University of Connecticut, December 4, 2015.
35. "Vibration Analysis of Spinning Rotors with Flexible Bearings and Housing Supports," Ohio State University, Columbus, OH, March 11, 2017.
36. "Development of an Acoustic Microactuator for Inner Ear Hearing Rehabilitation," keynote speech for 29th Conference on Mechanical Vibration and Noise, Cleveland, OH, August 6-9, 2017.
37. "Development of an Acoustic Microactuator for Inner Ear Hearing Rehabilitation," keynote speech for 42nd Conference on Theoretical and Applied Mechanics, Taipei, November 23-24, 2018.
38. "Development of an Acoustic Microactuator for Inner Ear Hearing Rehabilitation," Stevens Institute of Technology, Hoboken, NJ, April 10, 2019.
39. "Development of a PZT Nano-Composite Thin-Film Sensor for Structural Health Monitoring," University of Washington, Department of Material Science and Engineering, February 24, 2020.

40. "Development of a PZT Nano-Composite Thin-Film Sensor for Structural Health Monitoring," keynote speech for 14th International Conference on Micro- and Nanosystems, Virtual Conference, August 17-19, 2020.
41. "QUIVER – A Dental Implant Stability Analyzer," Invited Speaker of Institute of Translational Health Science (ITHS) Expo 2025, Seattle, WA., May 14, 2025.